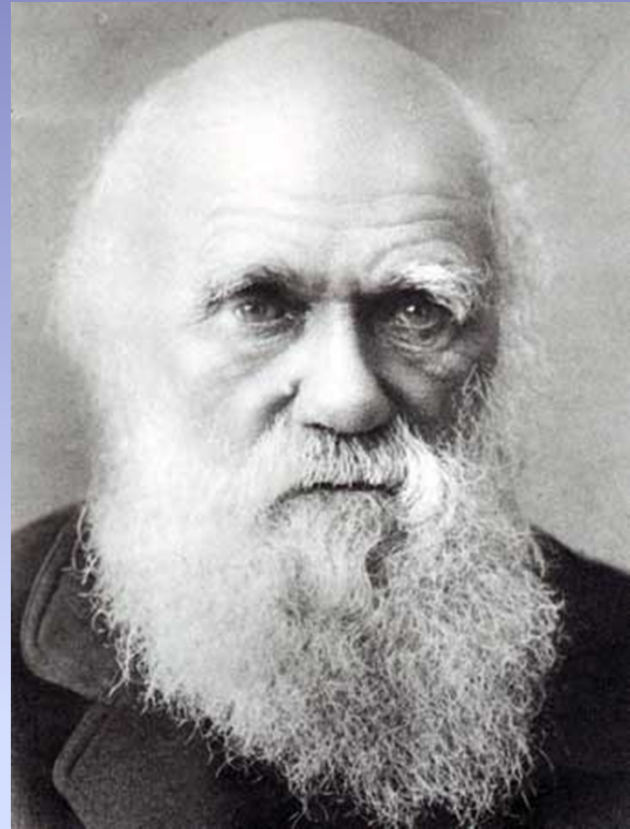


EVOLUTION

Darwin's Theory of Evolution

- **Evolution** =
 - Change over time
- Darwin noticed
 - Species vary globally
 - Species vary locally
 - Species vary over time
- Darwin studied **artificial selection** =
 - Selective breeding of organisms to promote occurrence of desirable traits in offspring

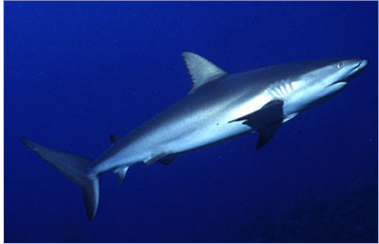


- **Fitness** =
 - How well an organism can survive and reproduce in an environment
- **Adaptation** =
 - Heritable characteristic that increases an organism's ability to survive and reproduce in an environment
- Individuals with adaptations suited to environment
 - Survive and reproduce
 - Have high fitness
- Individuals not well suited to environment
 - Die with little to no offspring
 - Have low fitness

- Adaptations can involve structures, functions, or behaviors (not acquired characteristics!)
 1. To cope with climate and other abiotic factors
 - Thick fur, hibernation, migration
 - Perennial bulbs, deciduous leaves
 2. To obtain food and water
 - Long neck, spider web, sharp teeth/claws
 - Root hairs, broad leaves



3. To defend against predators



- Camouflage/counter-shading, poison/warning coloration, spray, armor (quills, shells)
- Thorns, toxins



4. To attract mates OR pollinate and disperse seeds

- Sounds/calls, mating dance, exotic feathers, elaborate antlers
- Bright colors, fragrance, clinging burs, wings/parachute



- **Natural selection** =
 - Organisms that are most suited to their environment survive and reproduce
 - AKA: Survival of the fittest
 - Mechanism for evolution
 - Driven by competition and environmental change
 - Affects genotypes by acting on phenotypes
 - Increases frequency of beneficial alleles in a population
 - Acts only on inherited traits
 - Not acquired characteristics!

Evidence of Evolution

- Biogeography and Fossils
 - Study of where organisms lived in past and present
- Genetics and Molecular Biology
 - Universal genetic code
 - Homologous genes and proteins
- Embryology
 - Similar patterns of embryological development

- Anatomy
 - **Homologous structures** =
 - Similar structures in different species of common ancestry
 - Front limbs of vertebrates
 - *Supports descent with modification from common ancestor*
 - **Analogous structures** =
 - Share common function, not structure
 - Wing of bee and bird
 - *Not the clue to common descent*
 - **Vestigial structures** =
 - Inherited from ancestors but lost much or all of original function

Evolution of Populations

Genes and Variation

- **Gene pool** =
 - All the genes, including different alleles, that are present in a population at any one time
- **Allele frequency** =
 - Percentage an allele occurs in a gene pool
 - Has nothing to do with whether allele is dominant or recessive
- Evolution involves a change in the frequency of alleles in a ***population*** over time
 - Populations, not individuals, evolve

Sources of Genetic Variation

- Mutations
 - Any change in genetic material of a cell
 - Can affect individual genes or entire chromosomes
 - May or may not affect fitness
 - Matter in evolution only if passed from one generation to the next
- Genetic Recombination in Sexual Reproduction
 - Independent assortment
 - Crossing over
- Lateral Gene Transfer
 - Passing genes from one organism to another that is NOT offspring
 - Common in bacteria

Genetic Drift

- **Genetic drift** =
 - Random change in allele frequency
 - **Bottleneck effect** =
 - Change in allele frequency following a dramatic reduction in size of population
 - Can sharply reduce genetic diversity
 - **Founder effect** =
 - Change in allele frequencies as a result of migration of a small subgroup of population

Evolution vs Genetic Equilibrium

- **Genetic equilibrium** =
 - Situation in which allele frequencies in a population remain the same
 - Genetic equilibrium can be disturbed (thus causing evolution to occur) by:
 1. Nonrandom mating
 - **Sexual selection** = Individuals select mates based on heritable traits
 2. Small population size
 3. Immigration or emigration
 4. Mutations
 5. Natural selection

Isolating Mechanisms

- **Speciation** =
 - Formation of a new **species** =
 - Can interbreed and produce fertile offspring
- **Reproductive isolation** =
 - Separation of a species or population so that they no longer interbreed
 - Gene pools diverge
 - Evolve into 2 separate species

Reproductive isolation can develop through:

- **Behavioral isolation** =
 - 2 populations develop difference in courtship rituals or other behaviors
- **Geographic isolation** =
 - 2 populations are separated by geographic barriers
 - Ex: Rivers, mountains, water
- **Temporal isolation** =
 - 2 or more species reproduce at different times